DECAY-OUT OF SUPERDEFORMED BANDS BY COUPLING TO ORDERED OR CHAOTIC SPECTRA

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Superdeformed (SD) rotational bands provide states of specific energy and angular momentum which may act as probes of the rather dense spectrum of normally deformed (ND) states in which they are embedded. The internal excitation energy of SD bands in the mass 150 and 190 regions at their decay-out is around 3-5 MeV, that is midway between the near-yrast levels, which are known to be "ordered" in nature [1] and the neutron resonance states, which are known to be "chaotic".

The decay-out of superdeformed bands is caused by small admixtures of the neighboring ND states into the SD band. To describe the order-to-chaos properties of the ND states at decay-out, we apply ensembles of *sparse GOE matrices*. With increasing *effective dimensionality* d_{eff} of the sparse matrix, the rigidity of the spectrum evolves smoothly from the ordered to the chaotic situation [2]. In the present simulations, the SD state is coupled weakly to one basis state of a large GOE sparse matrix. A number N_{trans} of admixtures into the SD state are selected randomly from each simulation. The strongest N_{visib} of these admixtures represent the visible decay-out strengths [3] in experiments. As a function of effective dimensionality and number of transitions (d_{eff},N_{trans}) one can evaluate how likely is it that the experimental strengths might have been simulated with the sparse GOE matrices, as shown by three examples in the figure.

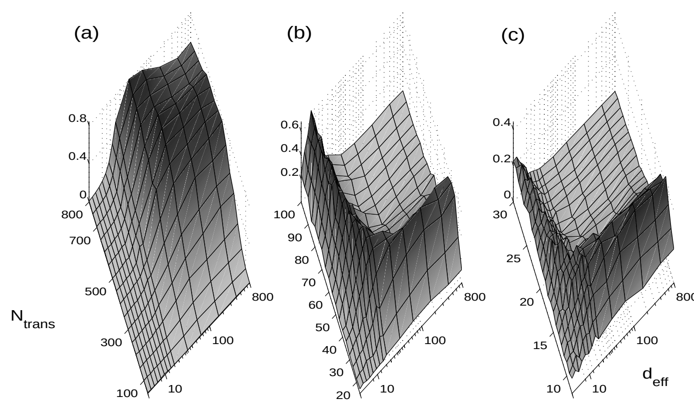

figure: The degree of compatibility of experimental and simulated strength distributions for (a) the 19 primary decay-out lines in ^{194}Hg, (b) the high transition energy interval for ^{194}Hg [3] with 9 transitions, (c) 6 resolved E1 transitions in ^{194}Pb. The basis size in simulations is 800.

For each set of data, a whole range of values of (d_{eff},N_{trans}) are possible, defined by a banana-shaped ridge of the plots, rather than a clear maximum. On the other hand, all results are found to be compatible with realistic level densities and *full GOE*, that is d_{eff} equal to the basis size. The lower limit $d_{eff} \geq 10$ determined by panel (a) implies that spectral rigidity should stretch over at least 8 levels [2].

[1] J. D. Garrett *et. al.*, Phys. Lett. **B392** (1997) 24.

[2] A. D. Jackson *et. al.*, Nucl. Phys. **A687** (2001) 405.

[3] A. P. Lopez-Martens *et. al.*, Nucl. Phys. **A647** (1999) 217.